PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION See Form PCT/IPEA/416	
67794-67867		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/SE 2002/000681	05.04.2002	26.03.2002
International Patent Classification (IPC) or national classification and IPC		
B67D 5/372, G01F 23/292, B60K 15/077		
Applicant		
IDENTIC AB et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 9 sheets, as follows:
      - ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☒ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
13.10.2003	24.06.2004
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INTERNATIONAL PRELIMI[redacted]Y REPORT ON PATENTABILITY

Inter[redacted]l application No.
PCT/SE 2002/000681

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

☐ international search (under Rules 12.3 and 23.1(b))
☐ publication of the international application (under Rule 12.4)
☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

☐ the international application as originally filed/furnished

☒ the description:

pages 1-12 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished
pages* _____ as amended (together with any statement) under Article 19
pages* 13-21 received by this Authority on 07.05.2004
pages* _____ received by this Authority on _____

☒ the drawings:

pages 1-5 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing *(specify)*: _____
☐ any table(s) related to the sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing *(specify)*: _____
☐ any table(s) related to the sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/SE 2002/000681

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-40, 44-47, 51-57	YES
	Claims	41-43, 48-50	NO
Inventive step (IS)	Claims	1-40	YES
	Claims	41-57	NO
Industrial applicability (IA)	Claims	1-57	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The following documents were cited in the International Search Report:

D1: US 3662924
D2: US 4053002
D3: US 4503994
D4: US 5785100
D5: EP 0697370
D6: GB 2138947
D7: US 3864577

Claims 1-40

The invention according to claim 1 refers to a method for spill-free refuelling comprising the establishing of a liquid tight connection between a refuelling gun nozzle and a coupling piece of the fuel receiving object and detecting a predetermined fuel level and interrupting the fuel flow when said level is detected. The method is characterised in that the level detection signalling system is established by moving the gun into a position for establishment of the liquid tight connection.

The invention according to claims 19 refers to a system for spill-free refuelling comprising means for the establishing of a liquid tight connection between a refuelling gun nozzle and a coupling piece of the fuel receiving object and further comprising means for detecting a predetermined fuel level and interrupting the fuel flow when said level is detected. The system is characterised in that the level detection signalling system is arranged to be established by means of moving the gun into a position for establishment of the liquid tight connection.

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box V

The invention solves the problem of having a spill-free connection confirmed establishing fuel level detection in a user friendly way.

D1 describes a light-controlled fluid dispenser. The dispenser solves the problem of overflowing during dispensing. According to D1, a prism is arranged in the outlet end of the dispenser. A fibre optic element connects the prism to a photocell, which controls the fuel valve. In operation a level detection signalling configuration in the form of a light signal is established when the dispenser is brought into connection with the fuel container. When the prism is wet, its refractive index changes and the light signal is interrupted, thus interrupting the fuel valve (col 5, lines 70-75).

D3 also describes a light-controlled fluid dispenser. A level detecting signalling configuration is established by inserting the dispenser into the fuel container and switching on the pump power switch. (col 3, lines 58-68, col 4, lines 1-30).

However, neither D1 nor D3 includes that the level detection signalling configuration is established by moving the gun into position for establishment of the liquid-tight connection. Therefore, D1 and D3 have been reconsidered to be of no particular relevance in view of claims 1-40.

Consequently, the method and system for spill-free refuelling according to claims 1-18 and 19-40 are considered to be novel and to comprise an inventive step. The method and system are also considered to be industrially applicable.

Claims 41-57
D6 describes a method and device for detecting the fuel level in a tank. According to D1, one or several prisms are provided in the tank. Each prism has a first optical fibre attached to its first surface and a second optical fibre attached to its second surface. A light source is provided close to the first fibre and a photocell is provided close to the second fibre. Light rays are transmitted through the first fibre, the rays are reflected of the prism and transmitted through the second fibre to the photocell.

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box V

When the prism becomes immersed in the liquid, the index of refraction changes and light can no more be reflected through the prism (page 3, lines 11-18, figure 4).

Consequently, the method according to claims 41-43 lacks novelty. Also, the device according to claims 48-50 lacks novelty.

The method according to claims 44-47 and the device according to claims 51-57 do only enclose embodiments obvious to a person skilled in the art and are therefore considered not to involve an inventive step.

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

The number of claims shall be reasonable in consideration of the nature of the invention claimed (PCT Rule 6.1)

Claims

1. Method for spill free refuelling comprising establishing a liquid tight connection between a refuelling gun nozzle for fuel dispensing and a coupling piece of the fuel receiving object, through which fuel is provided to a fuel container, detecting a predetermined fuel level and automatically interrupting the fuel flow when said level is detected,

characterized in that a level detection signalling configuration is established by moving the gun (1) into position for establishment of the liquid-tight connection.

2. Method according to claim 1, **characterized in** that signals (26') for detecting said predetermined level are transferred to the fuel container (7) from means (26, 27) carried and supported by the gun.

3. Method according to claim 1 or 2, **characterized in** that a signal corresponding to detection of said predetermined level is transferred to receiving means (28, 29), carried and supported by the gun for further processing.

4. Method according to claim 1, 2 or 3, **characterized in** that said predetermined level is detected by means of optical signals.

5. Method according to claim 4, **characterized in** that optical signals (26') are transferred from an optical fibre (26) and lens (27) arrangement on the gun and optical signals are received by an optical fibre (28) and lens (29) arrangement on the gun.

6. Method according to claim 4 or 5, **characterized in** that optical signals, preferably in the form of visible light, are transferred to reflection means (29', 37) in the container, the reflection means being arranged to reflect the optical signals when the fuel level has not reached the reflection means and to transmit a considerable part of the optical signals when the fuel has reached the reflection means due to a change in refractory configuration, and in, that the change in reflected signal is taken as an indication for the fuel to have reached the predetermined level.

7. Method according to claim 6, **characterized in** obtaining a certain deviation between transferred optical signals and reflected optical signals by the reflection

means so that means for transfer (26, 27) and means for receiving (28, 29) can be positioned close together on the gun, a preferred distance (d) between said means being about 6 mm:s.

8. Method according to claim 6 or 7, **characterized in**, that reflection of transferred optical signals is obtained by a prism and lens arrangement (37) preferably having an arcshaped configuration and being designed so that approximately the same reflection properties are obtained irrespective of where along said arrangement (37) transferred optical signals are coming in, whereby the gun may be applied and turned within a certain angle interval (38) substantially maintaining the effective reflection properties.

9. Method according to anyone of claims 6, 7 or 8, **characterized in** that, reflection is obtained by at least one cube corner prism (39).

10. Method according to claim 9, **characterized in** that reflection is obtained by at least three cube corner prisms arranged in a row.

11. Method according to anyone of claims 9 or 10, **characterized in** that each cube corner prism is provided with complementary optics (41) in the form of two lens parts (42, 43) for obtaining a deviation between transferred optical signals and reflected optical signals and for concentration of the reflected optical signals.

12. Method according to claim 8, 9, 10 or 11, **characterized in**, that optical signals are transferred through a slit (35) on the fuel receiving object side of the connection, the slit being fixed in relation to the reflection means, the slit setting said angle interval.

13. Method according to anyone of claims 1-12, **characterized in**, that complete and secure connection between the nozzle and the coupling piece is detected by means of the level detection signalling configuration, which is not fully established until said connection is completed.

14. Method according to anyone of claims 1-13, **characterized in**, that completed and acceptable connection between the nozzle and the coupling piece is indicated by a mechanical indication and release arrangement of the gun by moving a release

knob (9) from a release position to a coupling position, release of the connection being initiated by an operator pushing said knob back to the release position.

15. Method according to claim 14, **characterized in**, that reflected optical signals, are stopped from being communicated to further processing by shutter means (44) of a linkage arm (14) arrangement for the knob when said knob is in the release position, said communication being opened by moving said shutter means when the knob is moved to said coupling position.

16. Method according to anyone of the proceeding claims, **characterized in**, that the fuel connection between the nozzle and the coupling piece is opened in successive steps during the coupling procedure, so that the nozzle opens the coupling piece whereafter the coupling piece opens the nozzle, and vice versa when closing, so that the nozzle is closed first whereafter the coupling piece is closed.

17. Method according to anyone of claims 6-16, **characterized in**, carrying the reflection means by a fuel pipe (8), through which fuel is entered into the fuel container and which ends below said predetermined fuel level (8').

18. Method according to anyone of the preceeding claims, **characterized in**, a two-way optical communication between an object optical communication unit (45) and an optical control and communication unit (32).

19. System for spill free refuelling comprising means for establishing a liquid tight connection between a refuelling gun nozzle for fuel dispensing and a coupling piece of the fuel receiving object, through which fuel is intended to be provided to a fuel container of said object and further comprising means for detecting a predetermined fuel level and for automatically interrupting the fuel flow when said level is detected, **characterized in** that a level detection signalling configuration is arranged to be established by means of moving said gun (1) into position for establishment of the liquid tight connection.

20. System according to claim 19, **characterized in** that means (26, 27) carried and supported by the gun are provided for transferring signals (26') for detecting said predetermined level (8') to the fuel container (7).

21. System according to claims 19 or 20, **characterized in** that receiving means (28, 29) carried and supported by the gun are provided for receiving a signal corresponding to detection of said predetermined level (8') for further processing.

22. System according to claims 19, 20 or 21, **characterized by** optical signals (26') for detecting said predetermined level.

23. System according to claim 22, **characterized by** an optical fibre (26) and lens (27) arrangement on the gun for transferring optical detection signals (26') and an optical fibre (28) and lens (29) arrangement on the gun for receiving optical signals.

24. System according to claim 22 or 23, **characterized by** reflection means (29', 37) arranged in the container (7) for receiving optical signals, preferably in the form of visible light, transferred to the container, the reflection means being arranged to reflect the optical signals when the fuel level has not reached the reflection means and to transmit a considerable part of the optical signals when the fuel has reached the reflection means due to a change in refractory configuration and in that the change in reflected signal is taken as an indication for the fuel to have reached the predetermined level.

25. System according to claim 24, **characterized in** that the reflection means are arranged so that a certain deviation between transferred optical signals (26') and reflected optical signals is provided, so that means for transfer (26, 27) and means for reception (28, 29) may be positioned close together on the gun, a preferred distance (d) between said means being about 6 mm.

26. System according to claims 24 or 25, **characterized by** a prism and lens arrangement (37) for reflection of transferred optical signals (26') preferably having an arc-shaped configuration and having the same or approximately the same reflection properties irrespective of where along said arrangement transferred optical signals are coming in, whereby the gun may be applied and turned within a certain angle interval (38) substantially maintaining the effective reflection properties.

27. System according to claim 24, 25 or 26, **characterized by** at least one cube corner prism (39) comprised by the reflection means.

28. System according to claim 27, **characterized by** at least three cube corner prisms arranged in a, preferably arc-shaped, row comprised by said reflection means.

29. System according to claim 27 or 28, **characterized in** that each cube corner prism is provided with complementary optics (41) in the form of a lens arrangement for obtaining a deviation between transferred optical signals (26') and reflected optical signals (28') and for concentration of the reflected optical signals.

30. System according to claim 29, **characterized in** that said complementary optics comprise two lens parts (42, 43) arranged on a top surface (40) of a cube corner prism, each part being a portion of a lens and said parts abutting each other with their central portions (42', 43') and being arranged so that optical signals coming in against one part is reflected through the other part, the optical axes of the two parts being off-set with respect to each other and the center (39') of the prism.

31. System according to claim 30, **characterized in** that the general configuration of the two lens parts are off-spherical, one being spherical and one being cylindrical or both being off-spherical to a certain extent in order to accumulate lack of tolerances with respect to positioning of the optical signal transfer arrangement.

32. System according to anyone of claims 26-31, **characterized by** a slit (35) on the fuel receiving side of the connection, through which the optical signals (26', 28') are intended to pass, said slit preferably being arc shaped and being fixed in relation to the reflection means and setting said angle interval.

33. System according to anyone of claims 19-32, **characterized by** means (28, 44) for detecting complete and secure connection between the nozzle and the coupling piece by means of the level detection signalling configuration, said configuration being fully established when said connection is completed.

34. System according to anyone of claims 19-33, **characterized by** a mechanical indication and release arrangement of the gun for indication of complete and acceptable connection between the nozzle and the coupling piece, by moving a release knob (9) from a release position to a coupling position and release of the connection being initiated by an operator pushing said knob (9) back to the release position.

35. System according to claim 34, **characterized in** that the release knob (9) is supported by a linkage arm (14) arranged to co-act with a release ring (17) tiltably connected to an outer sleeve (18) of the nozzle, said sleeve being intended to be moved towards the coupling piece in relation to the release ring and an inner nozzle part (20) during the nozzle and coupling piece connection procedure, whereby the release ring is tilted and levelled out against a connection sleeve (21) of said inner nozzle part and whereby the release ring turns the linkage arm and the knob to said coupling position and in that, during release of the nozzle from the coupling piece, the linkage arm, by an operator pressing the knob to said release position, being arranged to tilt the release ring, which due to its attachment to the outer sleeve is arranged to push the connection sleeve towards the nozzle free end and thereby releasing the coupling piece from the nozzle.

36. System according to claim 34 or 35, **characterized by** shutter means (44) of a linkage arm arrangement for said knob, by means of which reflected optical signals are stopped from being communicated to further processing when said knob is in the release position, and in that said communication is opened by moving said shutter means when the knob is moved to said coupling position.

37. System according to anyone of claims 19-36, **characterized in** that the fuel connection between the nozzle and the coupling piece is arranged so that it is opened in successive steps during the coupling procedure, the nozzle being arranged to open

the coupling piece and the coupling piece being arranged to open the nozzle thereafter and vice versa when closing, the nozzle being closed before the coupling piece being closed.

38. System according to anyone of claims 19-37, **characterized in** that a fuel pipe (8) is provided, through which fuel is intended to be entered into the fuel container, said pipe acting as a support for the reflection means (29') and ending below said predetermined level (8').

39. System according to anyone of claims 19-38, **characterized by** a two-way optical communication between an object optical communication unit (45) of the fuel

receiving object carried by the object and an optical control and communication central unit (32).

40. System according to claim 39, **characterized in** that said two-way optical communication is arranged by means of light decoding and a communication prism (46) co-acting with a dual optical communication fibre (47) connected to the object optical communication unit (45).

41. Method for detecting a predetermined liquid fuel level comprising detecting the liquid level in a container for the liquid and producing an indication signal when said level is reached, **characterized by** the steps of

- arranging a transparent prism arrangement (37) in the liquid container (7);
- providing an optical detection signal (26') falling in against said prism arrangement;
- reflecting said signal by the prism arrangement and detecting the reflected signal (28');
- contacting the prism arrangement with the liquid when the predetermined level (8') is reached, whereby the refractory configuration is changed so that the signal to a considerable extent is transmitted into the liquid instead of being reflected
- detecting the decrease in reflected light.

42. Method according to claim 41, **characterized in** that said signals (26', 28') are beams of light, preferably visible light.

43. Method according to claim 41 or 42, **characterized by** arranging the prism arrange-ment so that a certain deviation takes place when the signal is reflected.

44. Method according to claims 41, 42 or 43, **characterized by** arranging the prism arrangement together with a lens arrangement (41) in an extended arrangement to provide reflection and deviation for different positions of the detection signal (26') relative to the prism and lens arrangement.

45. Method according to claim 41, 42, 43 or 44, **characterized by** reflecting said detection signal (26') by at least one cube corner prism (39).

46. Method according to claim 4, **characterized by** arranging at least three cube corner prisms in a row.

47. Method according to claim 45 or 46, **characterized by** deviating and concentrating the light reflected by a cube corner prism (39) by means of complementary optics (41) in the form of two lens parts (42, 43) arranged on a top surface (40) of the prism, the lens parts abutting each other by their central parts (42', 43'), and their optical axes (42'', 43'') being off-set with respect to each other and the center (39') of the prism.

48. Device for detecting a predetermined liquid fuel level, comprising means for detecting the liquid level and for producing an indication when said level is reached, **characterized by**

- reflection means (29') comprising a transparent prism arrangement and intended to be disposed in the container;
- means (26, 27) for providing an optical detection signal (26') intended to enter said prism arrangement;
- means (28, 29) for receiving and detecting reflected detection signals (28');

and in that

- the reflection means are arranged so that detection signals are reflected, when the liquid has not reached the reflection means, and are transmitted into the liquid when the liquid has reached the reflection means due to the change in refractory configuration.

49. Device according to claim 48, **characterized in** that said signals (26', 28') are beams of, preferably visible, light.

50. Device according to claim 48 or 49, **characterized in** that said prism arrangement is arranged so that a certain deviation is obtained between entering signal (26') and reflected signal (28').

51. Device according to claims 48, 49 or 50, **characterized by** a prism arrangement with complementary optics (41), comprising a lens arrangement arranged in an extended arrangement to provide reflection and deviation for different positions of the detection signal (26') relative to the prism and lens arrangement.

52. Device according to claim 48, 49, 50 or 51, **characterized in** that said reflection means comprise at least one cube corner prism (39).

53. Device according to claim 52, **characterized in** that said reflection means comprises at least three cube corner prisms arranged in a, preferably arc-shaped, row.

54. Device according to claim 52 or 53, **characterized by** complementary optics for deviation and concentration of signals in the form of two lens parts (42, 43) arranged on a top surface (40) of a cube corner prism (39), the lens parts abutting each other by their thickest central parts (42', 43') and their optical axes (42'', 43'') being off-set with respect to each other and the center (39') of the prism.

55. Device according to claim 54, **characterized in** that the optical axis (42'', 43'') of each lens (42, 43) falls within the respective lens material on the prism.

56. Device according to claim 54 or 55, **characterized in** that the line of cut (39'') between the two lens parts of a prism is directed to the rotation center of the reflection means, these being arranged in an arc-shaped configuration.

57. Device according to anyone of claims 50 – 56, **characterized in** that, due to deviation etc., the reflection means are arranged to produce two spots, one on each side of the signal transfer arrangement (26, 27), one of said spots being intended to fall on the means (28, 29) for receiving reflected detection signals for detection.